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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Log Event A

Borehole 40-01-08

Borehole Information

Farm : S	**Tank :** S-101	**Site Number :** 299-W23-147
N-Coord : 36,207	**W-Coord :** 75,707	**TOC Elevation :** 664.93
Water Level, ft :	**Date Drilled :** 9/30/1971	

Casing Record

Type : Steel-welded	Thickness, in. : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 100	

Borehole Notes:
According to the drilling record, this borehole was not perforated or grouted. The casing thickness is presumed to be 0.280 in., on the basis of the published thickness for schedule-40, 6-in. steel tubing. The top of the casing, which is the zero reference for the SGLS, rises approximately 2 ft above the top of a 3-ft-high transfer-line berm. Spectral logging was initiated at the top of the berm, approximately 2 ft below the top of the casing.

Equipment Information

Logging System : 2	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 05/1996	**Calibration Reference :** GJPO-HAN-5	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number :	1	**Log Run Date :**	05/30/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	2.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	3.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	2	**Log Run Date :**	05/30/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	2.5	**Counting Time, sec.:**	100	**L/R :** R	**Shield :** N
Finish Depth, ft. :	6.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	3	**Log Run Date :**	05/30/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	7.5	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	26.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Event A

Log Run Number :	4	**Log Run Date :**	05/31/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	5.5	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	7.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	5	**Log Run Date :**	05/31/1996	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	103.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	25.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Analysis Information

Analyst : E. Larsen

Data Processing Reference : P-GJPO-1787 Analysis Date : 02/26/1997

Analysis Notes :

This borehole was logged by the SGLS in five log runs. The pre- and post-survey field verification spectra met the acceptance criteria established for the peak shape and detector efficiency, confirming that the SGLS was operating within specifications. The energy calibration and peak-shape calibration from these spectra were used to establish the channel-to-energy parameters used in processing the spectra acquired during the logging operation.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

The top of the borehole casing rises approximately 2 ft above the top of a 3-ft-high transfer-line berm. Spectral logging was initiated at the top of the berm. The depths of all logging data are referenced to the distance below the top of the borehole casing.

The man-made radionuclides Cs-137, Co-60, and Eu-154 were detected in this borehole. The presence of Cs-137 was measured continuously from 2 to 8 ft. Scattered concentrations of Cs-137 were also detected from 10.5 to 15 ft and at the bottom of the logged interval (103 ft). The presence of Co-60 was detected almost continuously from 2 to 6.5 ft. A continuous zone of Eu-154 was detected from 2.5 to 6.5 ft.

The presence of Co-60 is indicated by the 1333-keV spectral peak. The presence of Eu-154 is indicated by the 1274-keV spectral peak.

From 2 to 7.5 ft, it was not possible to identify the 609-keV peak used to derive the U-238 concentrations. This occurred because high gamma-ray activity associated with the nearby Cs-137 peak (661 keV) created an elevated Compton continuum extending to the 609-keV region, causing the MDL to exceed the measured U-238 concentration. From 3.5 to 5 ft, it was not possible to identify the 1460- and 2614-keV peaks used to determine the K-40 and Th-232 radionuclide assay, probably because the high 661-keV radiation associated with the Cs-137 contamination produced spectral distortions that caused the MDLs associated with the 1460- and 2614-keV peaks to exceed the measurable radionuclide concentrations.

The KUT logs show an increase in the K-40 concentrations at a depth of 49 ft and again at 59 ft.

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Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank S-101.

Log Plot Notes:

Separate log plots show the man-made (Cs-137, Co-60, and Eu-154) and the naturally occurring radionuclides (KUT). The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.